Space Weather Technical Forecast

Issued on Friday, 17 June 2022 at 13:22 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Daily chance of isolated M-class flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low with only a few C-class flares, mostly originating from AR3030 and AR3031. There are currently 8 numbered sunspot regions on the visible disc, the largest and most complex one remaining AR3031 although recent imagery shows some decay in its intermediate spots. Two regions are showing signs of growth, AR3030 and AR3038, respectively in the northwest and northeast quadrant. All other spot groups are either unchanged in overall appearance, or showing some minor decay, and have more simplified uni-polar or bi-polar magnetic configurations.

No Earth-directed CMEs were observed in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR at L1, fluctuated between 520-630km/s. Density was at average levels and on a steady trend. The IMF was weak and varying between 5-8nT, while the north-south component fluctuated between +/-7nT. The phi angle was predominantly positive (away from the Sun), only briefly venturing into the negative sector around 17/0600 UTC. Geomagnetic activity was largely Quiet to Unsettled (Kp 1 to 3), with an Active interval (Kp 4) at 16/2100-2400 UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) measured by GOES16 remained very slightly above Background levels, but with no solar radiation storms thresholds reached.

Electron flux (greater than 2MeV) was at Background to Moderate levels, but has risen slightly today (16th) with a peak of 461 pfu at 16/1940 UTC. Corresponding 24-hour integrated electron fluence has been well below the Active (1e8 integrated pfu) threshold, although is now showing a rising trend. 9.2e6 integrated pfu was observed at 17/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Barring new development, solar activity is expected to be mostly Low with a chance of isolated M-class flares, most likely from AR3030 and AR3031.

Solar Wind / Geomagnetic Activity: No CMEs are currently expected to affect Earth during the period.

Solar winds are expected to remain largely elevated over the next three days, under the influence of CH90/+ then CH92/+. Solar winds should then decline on Day 4 (20th) as these features rotate away from a geo-effective position. Geomagnetic activity is expected to be mostly Quiet to Unsettled, but with a chance an Active or even a very slight chance of a G1/Minor Storm interval on Days 1 and 2 (17th and 18th), should we have a prolonged period of negative Bz. Geomagnetic activity becoming largely Quiet on Days 3 and 4 (19th and 20th).

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Met Office Space Weather Technical Forecast

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10 MeV) is expected to be very near Background during the period, with a daily Slight Chance of an S1 or greater event occurring.

High energy electron flux (greater than 2 MeV) is expected to start at Background to Moderate levels, but with a chance of increasing to High levels due to high speed stream influences. Electron fluence is expected to follow a gradual rising trend, with a peak chance of reaching Active (1e8 integrated pfu) levels by Day 3 (19th).

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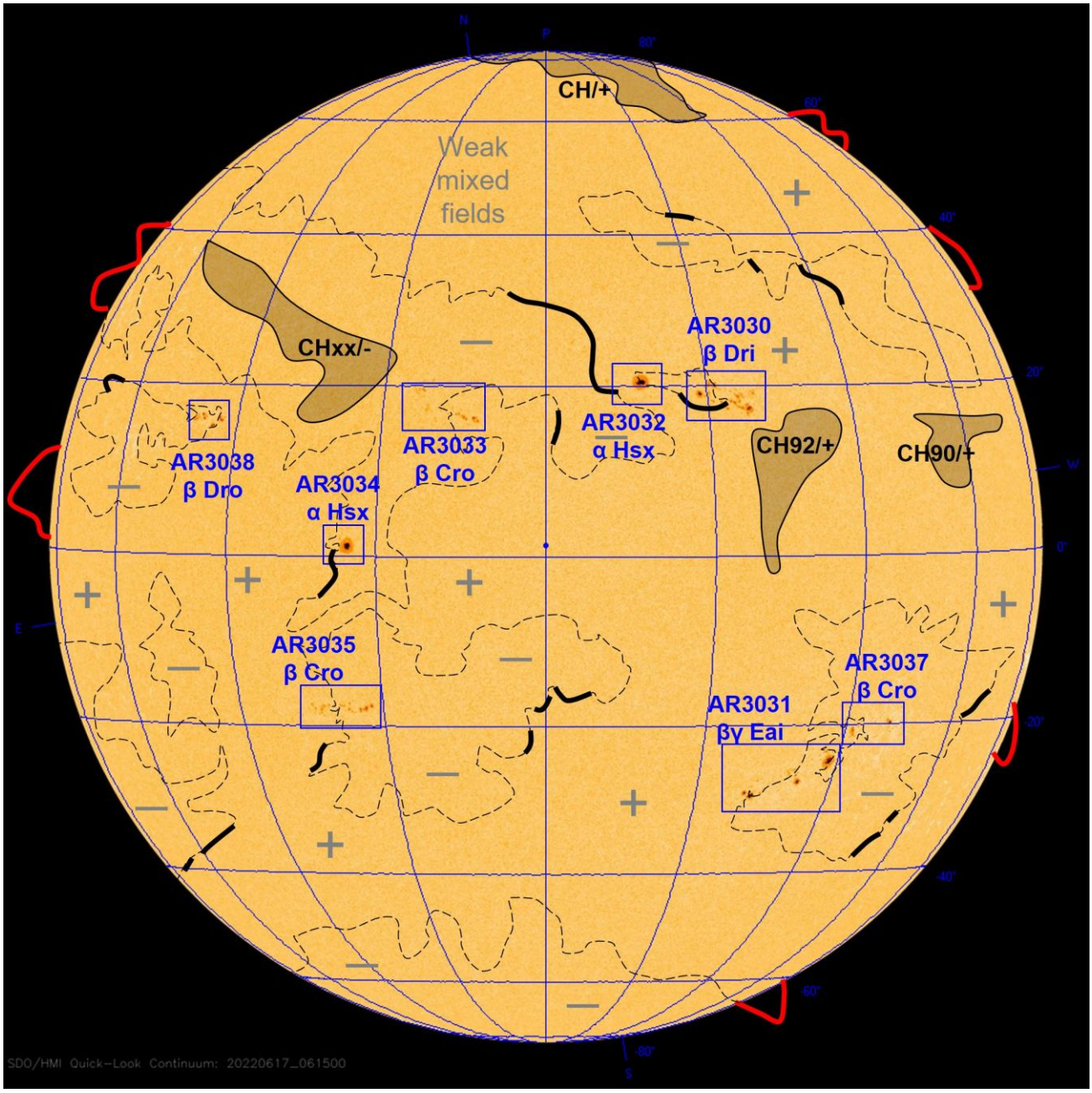
Figure 1. Solar Analysis Valid 17/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No CMEs are currently expected to affect Earth during the period.

Solar winds are expected to remain largely elevated over the next three days, under the influence of CH90/+ then CH92/+. Solar winds should then decline on Day 4 (20th) as these features rotate away from a geo-effective position. The solar wind briefly exceeded 600 km/s around 17/0600 UTC and around 17/1100 UTC but this was most likely the result of a sector boundary crossing, the phi angle becoming negative for a short time.

Geomagnetic activity is expected to be mostly Quiet to Unsettled, but with a chance an Active or even a very slight chance of a G1/Minor Storm interval on Days 1 and 2 (17th and 18th), should we have a prolonged period of negative Bz. Geomagnetic activity becoming largely Quiet on Days 3 and 4 (19th and 20th).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	5	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

NIL

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Radio Blackouts - X-Ray Flares:
There are currently 8 numbered sunspot regions. AR3031 remains the most complex region, currently transiting across the southwest quadrant. It is still modestly large in overall size, however further decay is evident in its minor intermediate spots, and the small Delta spot configuration has now vanished. AR3030 has recently grown, with a few additional intermediate spots, some of which display a penumbra. AR3038 is another region that recently grew, with several rudimentary penumbrae and the development of an isolated trailing spot. All other spot groups are either unchanged in overall appearance, or showing some minor decay, and have rather simple uni-polar or bi-polar magnetic configurations.

Despite the congested disc, X-ray flare activity has been limited, with only a few C-class flares. Two impulsive C4 flares were observed originating from AR3031 at 16/1344UTC and 17/0053 UTC. More recently two long duration flares were observed, a C2 peaking at 17/0630 UTC and a C5 peaking at 17/1123 UTC. The source has been identified as being AR3030 but there is currently no imagery available to confirm it. Solar activity is expected to continue mostly Low with a chance of isolated M-class flares, most likely from AR3030 and AR3031.

A bright flux region is visible around 110 East on EUVI/AIA 195 imagery, potentially indicating the emergence of a new region on Day 3 (19th).

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	30	30	30	30
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 2: Latest X-ray flare activity

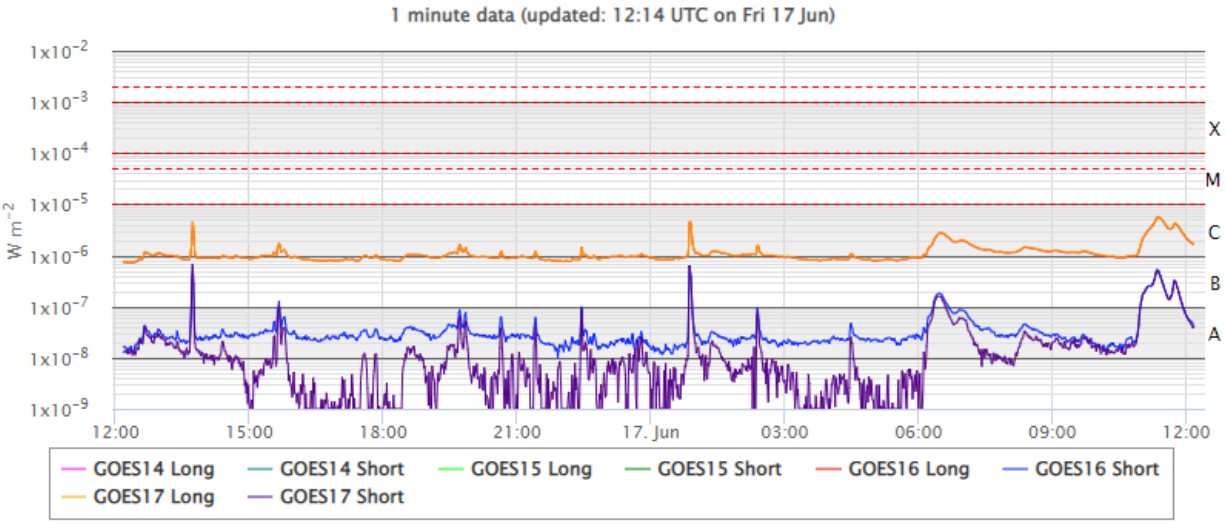

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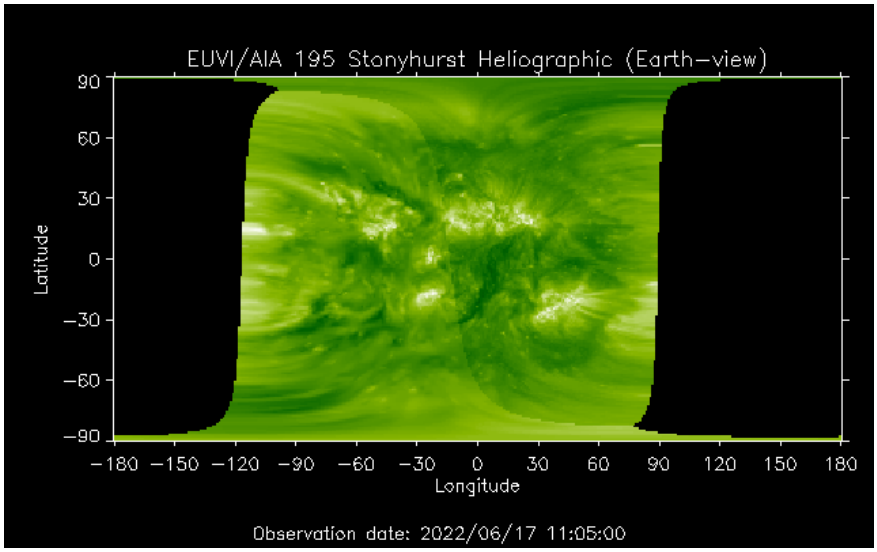
Figure 3: Latest EUVI/AIA 195 imagery showing a bright flux region around 110 East



Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) became very slightly elevated in the wake of the M3 flare that occurred on the 13th of June. However it remained well below S1 and is now showing a very slight decreasing trend.

There is a slight chance of an S1 or greater event in the period, as a result of the westward transit of AR3031, which is the most likely spot group of the current cohort to produce a significant flare. It is also in a favourable longitude, any CME originating from it most likely to be Earth-directed.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	10	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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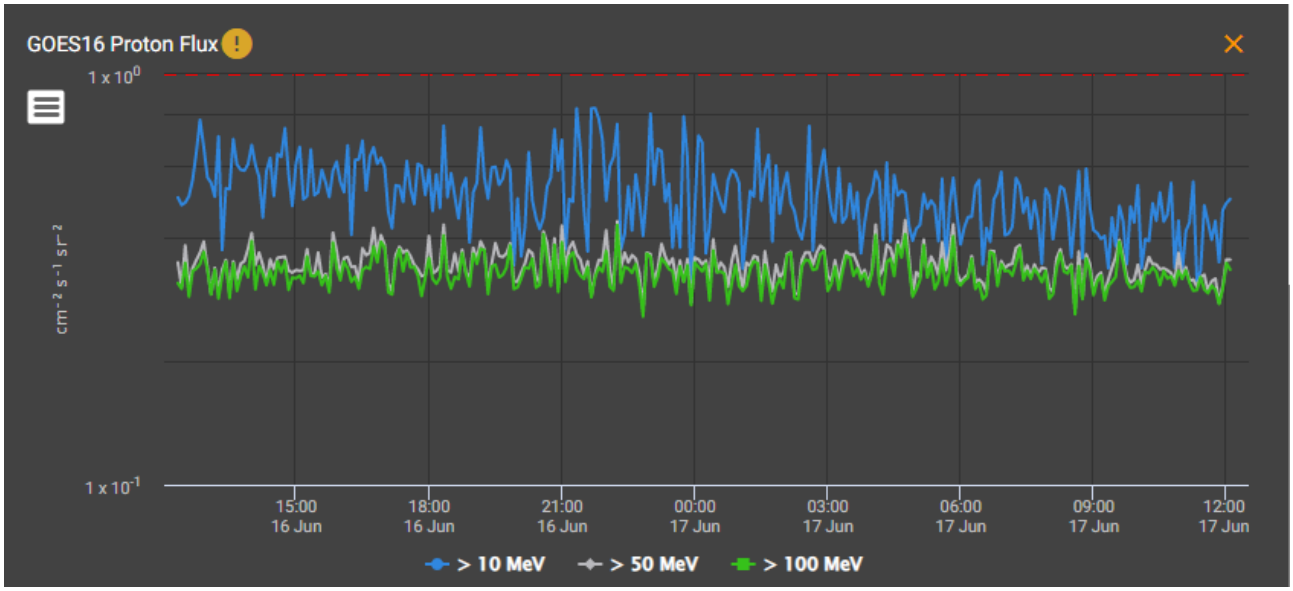
Figure 4: Latest Proton flux, as seen by GOES 16



High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) as observed by GOES16 is currently at Background to Moderate levels, but has risen slightly yesterday (16th) with a peak of 461 pfu at 16/1940 UTC. A further rising trend is likely in the coming few days under coronal hole high speed stream influences, with diurnal flux probably peaking into High levels.

The corresponding electron fluence is now expected to follow a gradual rising trend, with a chance of reaching or exceeding the Active (1e8 integrated pfu) threshold, perhaps most likely on Day 3 (19th). REFM output is considered to be a significant over-estimate on Days 2 and 3 (18th and 19th), with recurrence offering a more likely trend and suggesting marginal chance of Active fluence.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	10	30	50	40
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

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Figure 5: Latest Electron flux, as seen by GOES 16

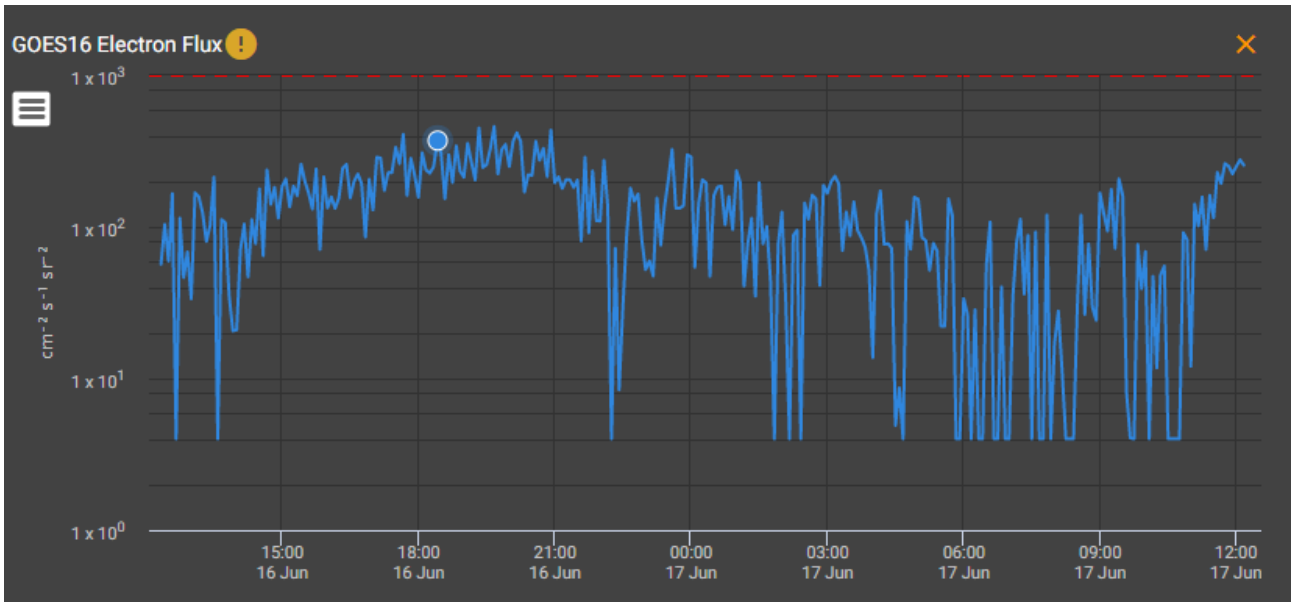
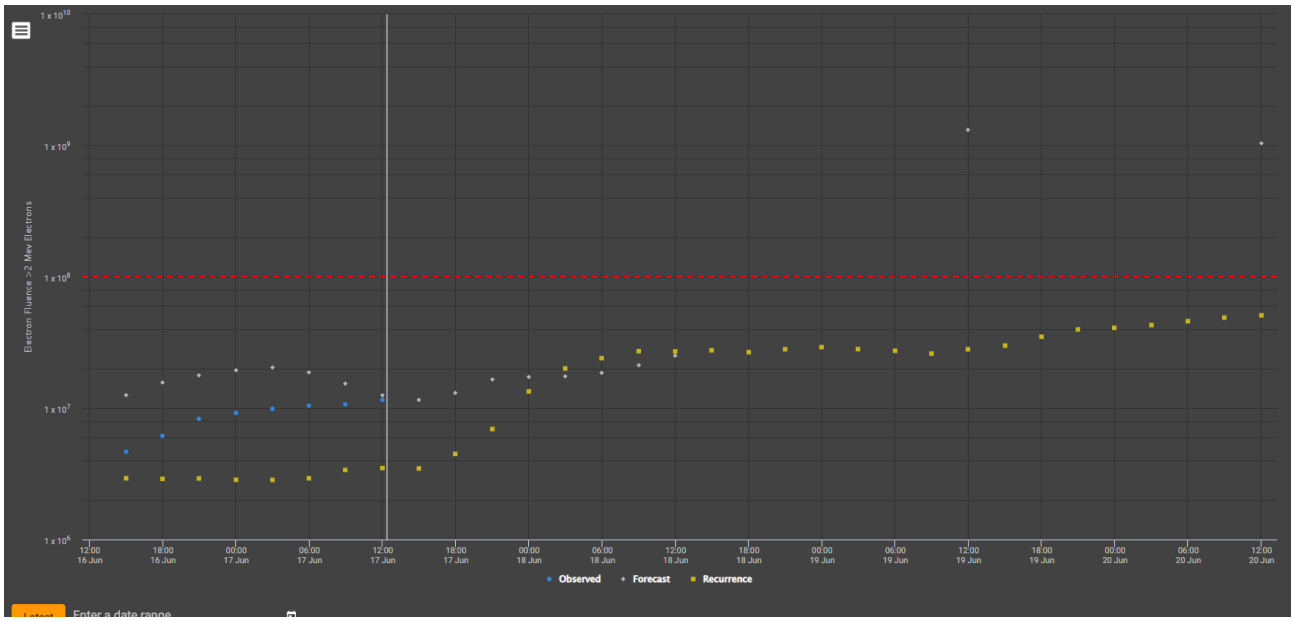


Figure 6: Latest Met Office REFM output, with recurrence (yellow dots) considered to offer better guidance



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